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The upper Viséan-Serpukhovian in the type area for the Serpukhovian Stage (Moscow Basin, Russia): Part 2. bulk geochemistry and magnetic susceptibility

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Abstract

© 2016 John Wiley & Sons, Ltd.This study is the summary analysis of bulk XRF geochemistry (233 samples from three sections) of the Oka and Zaborie groups of the type Serpukhovian succession in the Moscow Basin. The siliciclastic wedges in the limestone-dominated Oka Group are two to three times enriched in Fe, Ti, and Zr compared to Clarke values. Bulk iron strongly correlates with magnetic susceptibility. Iron tends to form ferruginized horizons (original siderites) in finer grained siliciclastic beds associated with coal seams. These beds also tend to be enriched in Cu, Ni, Pb, Zn, and other trace metals (metal enrichment horizons or MEHs). MEHs formed in ponded conditions of coastal low-pH marshlands vegetated by mangrove-like lycopsid bushes. Well-drained environments of palaeokarst formation and alkaline everglades (Akulshino palustrine event) on the other hand did not accumulate Fe and trace metals. The thin shale seam (found close to the Viséan-Serpukhovian boundary in Polotnyanyi Zavod) has unusually high Rb and Sr values, which may contain volcanigenic material useful for absolute dating. The Gurovo Formation (Steshevian Substage of the Serpukhovian) is less enriched in Fe and Ti. In the Gurovo Formation, the transition from the lower montmorillonitic shale (Glazechnya Member) to the upper palygorskitic shale (Dashkovka Member) is expressed by a five-fold increase in background MgO values, which indicates progressive shoaling and climatic aridization. Phosphorus remains close to 0% in the Oka Group and tends to increase in the Zaborie Group, in agreement with a dramatic increase of conodont numbers and other signatures of a lower Serpukhovian marine transgression. The lower half of the Glazechnya Member exhibits fluctuating enrichment in Fe, Cu, Ni, Pb, Zn, V, Cr, and Co. These fluctuations are mostly inverse to fluctuations of Mn. This pattern has been interpreted as a signature of seafloor oxygen deficiency, where Mn-rich samples record oxygen-poor environments (redox barrier level with the sediment surface) and Mn-poor samples enriched in Fe and trace metals record transitions to anoxic setting. This interval is interpreted as the Lower Serpukhovian highstand. Enrichment in Fe, Ti, and Zr of Oka siliciclastic units of Polotnyanyi Zavod indicates provenance from the ore-rich Voronezh Land, south of the Moscow Basin. The westerly flux regarded as a possible provenance in previous palaeogeographic reconstructions is discarded for the studied sections. The Gurovo Shale is also linked to the Voronezh province, although Fe, Ti, and Zr concentrations are lower than in the Oka shales.

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Keywords

Fluvial wedges, Magnetic susceptibility, Mississippian, Moscow basin, Provenance, Shale basin, Trace metals, XRF geochemistry